Shiga Toxin–Producing

Escherichia Coli (STEC)

Including *E. Coli* O157:H7

DISEASE REPORTABLE WITHIN 24 HOURS OF DIAGNOSIS

Per N.J.A.C. 8:57, healthcare providers and administrators shall report by mail or by electronic reporting within 24 hours of diagnosis, confirmed cases of STEC to the health officer of the jurisdiction where the ill or infected person lives, or if unknown, wherein the diagnosis is made. A directory of local health departments in New Jersey is available at http://www.state.nj.us/health/lh/directory/lhdselectcounty.shtml.

If the health officer is unavailable, the healthcare provider or administrator shall make the report to the Department by telephone to 609.588.7500, between 8:00 A.M. and 5:00 P.M. on non-holiday weekdays or to 609.392.2020 during all other days and hours.

CDS
Communicable Disease Service

NEW JERSEY DEPARTMENT of HEALTH and SENIOR SERVICES

June 2008

1 THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Escherichia coli, a gram-negative bacterium, has many different serotypes categorized into five major groups that are pathogenic to humans. These groups are designated according to virulence mechanisms: the first four are enterotoxigenic; enteropathogenic; enteroinvasive; and enteroaggregative; the last one includes Shiga toxin–producing *E. coli* (STEC), which was previously known as enterohemorrhagic *E. coli*. The most commonly reported STEC in the United States is *E.coli* O157:H7. Other serotypes such as 026:H11, 0111:H8, 0103:H2, 0113:H21, and O104:H21 have also been implicated as STEC strains.

B. Clinical Description and Laboratory Diagnosis

STEC bacteria produce potent cytotoxins, called shiga toxins. Infection with STEC, including *E. coli* O157:H7 may present with a wide spectrum of clinical manifestations. An individual may be asymptomatic, have mild non-bloody diarrhea, or have gross bloody diarrhea (hemorrhagic colitis). Most diagnosed cases of *E. coli* O157:H7 present with an onset of bloody diarrhea six to 48 hours after the onset of non-bloody diarrhea. Abdominal cramps, nausea, and vomiting may also be present. Fever is usually absent. Commonly the illness resolves in five to ten days. In severe cases, the patient may progress to develop hemolytic uremic syndrome (HUS) or thrombotic thrombocytopenic purpura (TTP), which can result in renal failure and death. Laboratory diagnosis is based on isolation of *E. coli* O157:H7 or another strain of STEC from feces or rectal swabs, by demonstrating the presence of Shiga toxin by enzyme immunoassay or by identifying the presence of toxin genes or virulence plasmids.

C. Reservoirs

Cattle appear to be a reservoir of significant public health importance; however, other animals, such as deer, are also known to carry STEC. In addition, humans may also serve as a reservoir.

D. Modes of Transmission

Transmission of STEC infection occurs fecal-orally through food, drinking water, or recreational water contaminated with human or animal feces containing the bacterium. Transmission may also occur directly from person to person; this can include certain types of sexual contact (e.g., oral-anal contact). STEC infection has been associated with the consumption of contaminated foods, such as inadequately cooked ground beef, unpasteurized apple juice and cider, unpasteurized milk and other dairy products, and raw vegetables.

E. Incubation Period

The incubation period for *E. coli* O157:H7 is two to eight days (or longer), most commonly three to four days. Other STEC serotypes have an incubation period that varies from ten hours to six days.

F. Period of Communicability or Infectious Period

STEC is shed in stool during at least the initial period of diarrhea, then variably for an unknown duration. These bacteria are shed for up to three weeks in about one-third of infected children. Prolonged carriage is uncommon.

G. Epidemiology

STEC infection was first identified in 1982 during an outbreak of *E. coli* O157:H7 in the United States. Since then, infections have been recognized as an important cause of bloody diarrhea in North America, Europe, Japan, Australia, and southern South America. As with other enteric illnesses, the young and old are usually more severely ill when infected with STEC. Infection in young children may lead to complications such as HUS in about 5% to 10% of cases. Sporadic cases occur throughout the year with a peak incidence of disease during the summer months. Outbreaks in the United States have been associated with ground beef, unpasteurized milk and apple cider, raw vegetables, and other food products.

2 CASE DEFINITION

A. New Jersey Department of Health and Senior Services (NJDHSS) Case Definition

1. Clinical Description

An infection of variable severity characterized by diarrhea (often bloody) and abdominal cramps. Illness may be complicated by HUS or TTP; asymptomatic infections also may occur and the organism may cause extraintestinal infections.

2. Laboratory Criteria for Diagnosis

- Isolation of Shiga toxin–producing *E. coli* from a clinical specimen. *E. coli* O157:H7 isolates may be assumed to be Shiga toxin–producing. For all other *E. coli* isolates, Shiga toxin production or the presence of Shiga toxin genes must be determined to be considered STEC.

CONFIRMED
A case with isolation of Shiga toxin–producing *E. coli* from a clinical specimen.

NOTE: *E. coli* O157:H7 isolates may be assumed to be Shiga toxin–producing. For all other *E. coli* isolates, Shiga toxin production or the presence of Shiga toxin genes must be determined to be considered STEC.

PROBABLE
A case with isolation of *E. coli* O157 from a clinical specimen, without confirmation of H antigen or Shiga toxin production, OR

A clinically compatible case that is epidemiologically linked to a confirmed or probable case, OR

Identification of an elevated antibody titer to a known Shiga toxin–producing *E. coli* serotype from a clinically compatible case.

POSSIBLE
A case of postdiarrheal HUS or TTP (see HUS case definition), or identification of Shiga toxin in a specimen from a clinically compatible case without the isolation of the Shiga toxin–producing *E. coli*.

B. Differences from CDC Case Definition

The formal Centers for Disease Control and Prevention (CDC) surveillance case definition for STEC is the same as the criteria outlined in section 2A. CDC case definitions are used by state health departments and CDC to maintain uniform standards for national reporting. For reporting a case to NJDHSS, always refer to the criteria in section 2A.

3 LABORATORY TESTING AVAILABLE

The New Jersey Department of Health and Senior Services (NJDHSS) Public Health and Environmental Laboratories (PHEL) will test stool specimens for the presence of STEC in an outbreak situation and will also confirm and serotype isolates of STEC obtained from clinical specimens at other laboratories. PHEL requests that all laboratories submit within three days **ALL** isolates cultured for typing to aid in public health surveillance (NJAC 8:57-1.6 [f]).

The general policy of PHEL is to test only food samples implicated in suspected outbreaks, not in single cases (except when botulism is suspected). The health officer may suggest that persons who possess food items implicated in a sporadic case either locate a private laboratory that will test food or store the food in their freezer for a period of time in case additional reports are received. All testing of food and clinical samples must have prior approval from staff from the Infectious and Zoonotic Diseases Program (IZDP). For more information contact PHEL at 609.292.7368.

NOTE: Isolates of STEC must be submitted to NJDHSS, Division of Public Health and Environmental Laboratories, PO Box 361, John Fitch Plaza, Trenton, NJ 08625-0361.

4 PURPOSE OF SURVEILLANCE AND REPORTING AND REPORTING REQUIREMENTS

A. Purpose of Surveillance and Reporting

- To identify whether the case-patient may be a source of infection for other persons (e.g., a diapered child, daycare attendee, or foodhandler) and, if so, to prevent further transmission.
- To identify transmission sources of major public health concern (e.g., a restaurant or commercially distributed food product) and to stop transmission from such sources.
- To provide education about reducing the risk of infection.

B. Laboratory Reporting Requirements

The New Jersey Administrative Code (NJAC 8:57-1.6) stipulates that laboratories report (by telephone, by confidential fax, or over the Internet using the Communicable Disease Reporting and Surveillance System [CDRSS]) all cases of STEC to the local health officer having jurisdiction over the locality in which the patient lives or, if unknown, to the health officer in whose jurisdiction the healthcare provider requesting the laboratory examination is located. The report shall contain, at a minimum, the reporting laboratory's name, address, and telephone number; the age, date of birth, gender, race, ethnicity, home address, and telephone number of person tested; the test performed; the date of specimen collection; the date of testing; the test results; and the healthcare provider's name and address.

C. Healthcare Provider Reporting Requirements

NJAC 8:57-1.4 stipulates that healthcare providers report (by telephone, by confidential fax, or in writing) all cases of STEC to the local health officer having jurisdiction over the locality in which the patient lives or, if unknown, to the health officer in whose jurisdiction the healthcare provider requesting the laboratory examination is located. The report shall contain the name of the disease; date of illness onset; and name, age, date of birth, race, ethnicity, home address, and telephone number of the person they are reporting. In addition,

name, address, institution and telephone number of reporting official and other information may be required by NJDHSS concerning a specific disease.

D. Local Board of Health Reporting and Follow-Up Responsibilities

NJAC 8:57-1.7 stipulates that each local health officer must report the occurrence of any case of STEC within 24 hours of receiving a report from a laboratory or healthcare provider to NJDHSS IZDP. A report can be mailed or filed electronically over the Internet using the confidential and secure CDRSS.

5 CASE INVESTIGATION

A. Forms

It is the health officer's responsibility to complete a "STEC Worksheet" reporting form by interviewing the patient and others who may be able to provide pertinent information. Much of the Clinical information can be obtained from the patient's healthcare provider or the medical record.

- When asking about exposure history (e.g., food, travel, activities), use the incubation period range for STEC (0−8 days). If possible, record any restaurants at which the patient ate, including food item(s) and date consumed.
- In a case of an outbreak, immediately notify the NJDHSS IZDP by telephone at 609.588.7500 during business hours and 609.392.2020 after business hours and on weekends and holidays.
- If there have been several unsuccessful attempts to obtain patient information, please fill out the worksheet with as much information as possible. Please note on the worksheet why it could not be filled out completely. After completing the report, attach lab report(s) and mail (in an envelope marked "Confidential") to IZDP or, alternatively, file the report electronically over the Internet using the confidential and secure CDRSS. The mailing address is:

NJDHSS
Division of Epidemiology, Environmental and Occupational Health
Infectious and Zoonotic Diseases Program
PO Box 369
Trenton, NJ 08625-0369

B. Entry into CDRSS

The mandatory fields for all cases in CDRSS include: disease, last name, county, municipality, gender, race, ethnicity, case status, report status.

The following table can be used as a quick reference guide to determine which fields in CDRSS are necessary for accurate and complete reporting of *SHIGA TOXIN-PRODUCING E.COLI (STEC)* cases. The first column represents the tabs along the top of the CDRSS screen. The Required Fields column reflects a detailed explanation of the essential data for each tab.

CDRSS Screen	Required Information
Patient Info	Enter disease name "*SHIGA TOXIN–PRODUCING ESCHERICHIA COLI (STEC)*", patient demographics, patient onset and date report was made to the local health department. There are three subgroups for STEC, ("NOT SEROGROUPED", "NON 0157:H7", AND "0157:H7") select the appropriate subgroup as noted in lab results. **NOTE:** If status of 0157:H7 isolation is unknown select subgroup "NOT SEROGROUPED."
Addresses	Determine whether the case-patient attends or works at a daycare facility and/or is a food handler or healthcare provider. Use as needed for additional addresses (e.g., work address, school, temporary NJ address for out-of-state case). Use the Comments section in this screen to record any pertinent information about the alternate address (e.g., the times per week the case-patient attends daycare).Entering an alternate address will allow other disease investigators access to the case if the alternate address falls within their jurisdiction.
Clinical Status	Clinical information such as past medical history, any treatment that the patient received, name of medical facility(s) including date of initial healthcare evaluation and dates of hospitalization, treating physician(s), and mortality status are entered here. (**NOTE:** If the patient received care from two or more medical facilities, be sure all are recorded in the case including admit/discharge dates so the case can be accessed by all infection control professionals (ICPs) covering these facilities.)
Signs/Symptoms	Make every effort to get complete information by interviewing the physician, family members, ICP, or others who might have knowledge of the patient's illness. Check appropriate boxes for signs and symptoms and indicate their onset and resolution.

CDRSS Screen	Required Information
Risk Factors	Enter complete information about risk factors including complete food history, travel history, any gatherings or outdoor activities attended, questions about water supply (STEC may be acquired through water consumption), pet or other animal contact and record in the Comments section. When asking about exposure history (e.g., food, travel, activities), use the incubation period range for STEC (0−8 days).
Laboratory Eval	• "SHIGA TOXIN-PRODUCING E.COLI (STEC)/NOT SEROGROUPED" select laboratory test name "MICROORGANISM IDENTIFIED" • "SHIGA TOXIN-PRODUCING E.COLI (STEC)/NON 0157:H7" select laboratory test name "*ESCHERICHIA COLI* SHIGA-LIKE" • "SHIGA TOXIN-PRODUCING E.COLI (STEC)/STEC 0157:H7" select laboratory test name "*ESCHERICHIA COLI* O157:H7" Enter Lab Specimen ID, Specimen, Date specimen collected, Lab Name, Referring Physician Name, Referring Medical Facility name, Test Result i.e., Positive/reactive or Negative/no reactive.
Contact Tracing	All potentially exposed contacts are entered into the contact tracing tab for local, county and statewide surveillance efforts. CDRSS requires a "YES" response to one of the two SHIGA TOXIN-PRODUCING E.COLI (STEC) exposure questions in order to add case contacts. Contacts are added individually by selecting the Enter Contact By Name feature: Each contact record reflects the period of exposure, symptomatic or asymptomatic, contact demographics, telephone numbers, marital status, primary language, exposure risk i.e., close, casual, unknown, and LHD response activities are noted. An exposure setting is selected for each contact from the drop down to the right of the contact's name. A summary reflecting the following contact details: total number, name, age, relationship, exposure specifics as well as all LHD recommendations to prevent further transmission of illness are entered into the contact tracing text box.

CDRSS Screen	Required Information
Case Comments	Any additional case investigation findings that can not be entered in discrete data fields are documented in the general comment section.
Epidemiology	Select the route of transmission route, import status of infection i.e., whether the case was imported and from where (another county, state, country), LHD notification of illness and association with high-risk venue type, name, location and last day of attendance, whether case-patient is a daycare worker or attendee, foodhandler, or healthcare worker. The NJDHSS assigned outbreak or investigation number is selected for all involved cases which automatically populates a summary of the initial report.
Case Classification Report Status	Case status options are: "REPORT UNDER INVESTIGATION (RUI)," "CONFIRMED," "PROBABLE," "POSSIBLE," and "NOT A CASE." • All cases entered by laboratories (including LabCorp electronic submissions) should be assigned a case status of "REPORT UNDER INVESTIGATION (RUI)." • Cases still under investigation by the LHD should be assigned a case status of "REPORT UNDER INVESTIGATION (RUI)." • Upon completion of the investigation, the LHD should assign a case status on the basis of the case definition. "CONFIRMED," "PROBABLE," "POSSIBLE," and "NOT A CASE" are the only appropriate options for classifying a case of SHIGA TOXIN-PRODUCING E.COLI (STEC). Report status options are: "PENDING," "LHD OPEN," "LHD REVIEW," "LHD CLOSED," "DELETE," "REOPENED," "DHSS OPEN," "DHSS REVIEW," and "DHSS APPROVED." • Cases reported by laboratories (including LabCorp electronic submissions) should be assigned a report status of "PENDING." • Once the LHD begins investigating a case, the report status should be changed to "LHD OPEN." • The "LHD REVIEW" option can be used if the LHD has a person who reviews the case before it is closed (e.g., health officer or director of nursing). • Once the LHD investigation is complete and all the data are entered into CDRSS, the LHD should change the report status

CDRSS Screen	Required Information
	to "LHD CLOSED." • "LHD CLOSED" cases will be reviewed by DHSS and be assigned one of the DHSS-specific report status categories. If additional information is needed on a particular case, the report status will be changed to "REOPENED" and the LHD will be notified by e-mail. Cases that are "DHSS APPROVED" cannot be edited by LHD staff. If a case is inappropriately entered as a case of SHIGA TOXIN-PRODUCING E.COLI (STEC) the case should be assigned a report status of "DELETE." A report status of "DELETE" should NOT be used if a reported case of SHIGA TOXIN-PRODUCING E.COLI (STEC) simply does not meet case definition. Rather, it should be assigned the appropriate case status, as described above.

C. Other Reporting/Investigation Issues

1. Case report forms (STEC Worksheet and labs) DO NOT need to be mailed to NJDHSS as long as mandatory fields in CDRSS indicated in section B are completed.

2. Once LHD completes its investigation and assigns a report status of "LHD CLOSED," NJDHSS will review the case. NJDHSS will approve the case by changing the report status to "DHSS APPROVED." At this time, the case will be submitted to CDC and the case will be locked for editing. If additional information is received after a case has been placed in "DHSS APPROVED," you will need to contact NJDHSS to reopen the case. This should be done only if the additional information changes the case status of the report.

3. Every effort should be made to complete the investigation within three months of opening a case. Cases that remain open for three months or more and have no investigation or update notes will be closed by NJDHSS.

6 CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (NJAC 8:57-1.10)

Food handlers with STEC infection must be excluded from work.

NOTE: A foodhandler is any person directly preparing or handling food. This can include a person providing direct patientcare (e.g., a nurse who administers medications orally) or a childcare provider.

1. Minimum Period of Isolation of Patient

After diarrhea has resolved, food handlers may return to work only after producing two successive negative stool specimens, collected no less than 24 hours apart but not sooner than 48 hours after completion of antibiotic therapy (if antibiotics are given).

2. Minimum Period of Quarantine of Contacts

Contacts with diarrhea who are food handlers shall be considered the same as a case-patient and handled in the same fashion. No restrictions need to be implemented otherwise.

3. Controlling Outbreaks

In suspected STEC outbreaks associated with a commercial food establishment, all food handlers who prepared the suspected or implicated meal/food should submit a stool specimen for culture. Personnel who have or who had symptoms of vomiting or diarrhea at the time the suspected food was prepared should be excluded from work immediately. Other food handlers who deny illness should be excluded only if they do not submit a stool specimen in a timely manner (usually by the next business day).

Asymptomatic food handlers infected with STEC should be excluded from direct food handling responsibilities until they have at least two consecutive negative stools because of the difficulty in monitoring and ensuring good hygiene. Consideration may be given to allowing such asymptomatic infected food handlers to engage in activities at the food establishment that do not involve direct food handling. IZDP should be consulted in situations where the course of action is unclear.

B. Protection of Contacts of a Case

None.

C. Managing Special Situations

1. Daycare

Because STEC may be transmitted person to person through the fecal-oral route, it is important to follow up cases of STEC that occur in a daycare setting carefully. If a case of HUS is diagnosed in a daycare, please see the chapter on HUS for recommendations. General recommendations include the following:

- Children and staff with STEC infection should be excluded until their diarrhea has resolved and two successive stool cultures are negative for STEC collected no less than 24 hours apart but no sooner than 48 hours after completion of antibiotic therapy (if antibiotics are given).
- Infection control procedures including proper hand washing, sanitary disposal of diapers and feces, proper food handling, and environmental sanitation should be implemented.

2. School

Because STEC may be transmitted person to person through the fecal-oral route, it is important to follow up cases of STEC that occur in a school setting carefully. General recommendations include the following:

- Students or staff with STEC infection who have diarrhea should be excluded until their diarrhea has resolved.
- Students or staff with STEC infection who do not handle food, have no diarrhea, and are not otherwise sick may remain in school if special precautions are taken.
- Students or staff who handle food and have STEC infection (symptomatic or not) must not prepare food until their diarrhea has resolved and they have two successive negative stool tests collected 24 hours or more apart, but not sooner than 48 hours after completion of antibiotic therapy (if antibiotics are given).

3. Community Residential Programs and Other Institutional Settings

Actions taken in response to a case of STEC infection in a community residential program will depend on the type of program and the level of functioning of the residents.

In **long-term care facilities**, residents with STEC infection should be placed on standard (including enteric) precautions until their symptoms subside and they test negative for STEC. Staff members who provide direct patientcare (e.g., feed patients, give mouth or denturecare, or give medications) are considered food handlers and are subject to food handler restrictions (see section 6A above). In addition, staff members infected with STEC who are not food handlers should not work until their diarrhea has resolved.

In **residential facilities** for the developmentally disabled, staff and clients with STEC infection must refrain from handling or preparing food for residents until their diarrhea has resolved and they have two successive negative stool tests for STEC infection (collected 24 hours or more apart, but not sooner than 48 hours after completion of antibiotic therapy, if antibiotics are given).

In addition, staff members infected with STEC who are not food handlers should not work until their diarrhea has resolved.

In addition to reporting an outbreak to the local health department, facility management from **long-term care facilities** must report any such outbreak to the NJDHSS Division of Long-Term Care Compliance and Surveillance Program, by telephone at 1.800.792.9770 or fax at 609.633.9060. A written report should be mailed within 72 hours to NJDHSS, LTC Compliance and Surveillance Program, PO Box 367, Trenton, NJ 08625.

4. Reported Incidence Is Higher Than Usual/Outbreak Suspected

If the number of reported cases of STEC in a city/town is higher than usual, or if an outbreak is suspected, investigate to determine the source of infection and mode of transmission. A common vehicle (such as water, food, or association with a daycare center) should be sought and applicable preventive or control measures should be instituted. If food is a suspect source of infection, use the Patient Food History Listing and Patient Symptoms Line Listing (insert

hyperlink) forms to facilitate recording additional information. Control of person-to-person transmission requires special emphasis on personal cleanliness and sanitary disposal of feces. Consult with IZDP at 609.588.7500. IZDP staff can help determine a course of action to prevent further cases and perform surveillance for cases that may cross several jurisdictions that would otherwise be difficult to identify at a local level.

D. Preventative Measures

Environmental Measures

Implicated food items must be removed from the environment. A decision about testing implicated food items can be made in consultation with IZDP and the Food and Drug Safety Program (FDSP). If a commercial product is suspected, FDSP will coordinate follow-up with relevant outside agencies. FDSP may be reached at 609.588.3123.

NOTE: The role of FDSP is to provide policy and technical assistance with the environmental investigation such as interpreting the New Jersey Food Code, conducting a hazardous analysis and critical control points risk assessment, initiating enforcement actions, and collecting food samples.

7 PERSONAL PREVENTIVE MEASURES/EDUCATION

To prevent infection, advise individuals of the following:

- Always wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet, and after changing diapers. (After changing diapers, wash the diapered child's hands.)
- In a daycare setting, dispose of feces in a sanitary manner.
- Caregivers providing care for someone with diarrhea should wash their own hands (and the hands of the person receiving care as appropriate) with plenty of soap and water after cleaning the bathroom, helping the person use the toilet, or changing diapers, soiled clothes, or soiled sheets.
- Avoid sexual practices that may permit fecal-oral transmission. Latex barrier protection should be emphasized as a way to prevent the spread of STEC infection to a case patient's sexual partners, as well as being a way to prevent the exposure to and transmission of other pathogens.
- If diagnosed with STEC, seek medical attention if symptoms compatible with HUS occur. (See chapter on HUS.)
- Wash fruits and vegetables thoroughly, especially those that will not be cooked.
- Cook all ground beef and hamburger thoroughly. Make certain the cooked meat is a gray or brown color throughout (not pink) and the meat juices run clear; the inside should be hot.
- Drink only pasteurized milk, juice, or cider.

Additional Information

An STEC Fact Sheet can be obtained at the NJDHSS Web site at http://www.state.nj.us/health. Click on the "Topics A to Z" link and scroll down to the subject "STEC."

Additional information can be obtained from the US Food and Drug Administration's Center for Food Safety and Applied Nutrition Web site at www.cfsan.fda.gov.

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